CLAIMS

1. A method of suppressing narrowband interference in OFDM receivers including the steps of;

acquiring a sample of received data,

estimating parameters of each of a number of narrowband interferers from the acquired sample of data,

forming an excision filter using the estimated parameters, and

inserting the excision filter into an OFDM receiver.

2. A method of suppressing narrowband interference in OFDM receivers as claimed in claim 1 further including the step of inserting the excision filter into the OFDM receiver prior to a discrete Fourier transform.

3. A method of suppressing narrowband interference in OFDM receivers as claimed in claim 1 or claim 2 wherein the estimated parameters of the narrowband interferers include demodulated carrier frequency, magnitude and phase.

4. A method of suppressing narrowband interference in OFDM receivers as claimed in any one of claims 1 to 3 wherein the step of estimating the number of narrowband interferers includes the steps of;

performing a forward DFT on the samples, and

performing a periodogram search on the output of the DFT to identify peaks in the periodogram where the number of peaks in the periodogram corresponds to the number of interferers.

5. A method of suppressing narrowband interference in OFDM receivers as claimed in any one of claims 1 to 4 wherein the step of estimating parameters of the narrowband interferers includes the steps of;

estimating the frequency of an interferer as the location of a peak on the corresponding periodogram,

estimating the magnitude of the interferer as the amplitude of the corresponding periodogram peak, and

estimating the phase of the interferer as the phase of the corresponding periodogram peak.

6. A method of suppressing narrowband interference in OFDM receivers as claimed in any one of claims 1 to 5 including the step of initialising one digital phase lock loop for each estimated narrowband interferer using the narrowband interferer parameter estimates.

7. A method of suppressing narrowband interference in OFDM receivers as claimed in any one of claims 1 to 6 further including the step of receiving an indication of a start of packet when a data packet is received by the OFDM receiver.

8. A method of suppressing narrowband interference in OFDM receivers as claimed in claim 6 including the step of updating each phase lock loop each incoming sample until either a counter expires or an OFDM packet is detected.

9. A method of suppressing narrowband interference in OFDM receivers as claimed in claim 8 wherein the phase locked loops are digital phase locked loops.

10. A method of suppressing narrowband interference in OFDM receivers as claimed in any one of claims 6, 8 and 9 including the step of initialising the excision filter with the current narrowband interferer carrier frequency estimates from the phase locked loops that have achieved "lock" when an OFDM packet is detected.

11. An OFDM receiver including;

a front end arranged to receive data,

a data sampler arranged to provide samples of received data,

a narrowband interference detector that detects narrowband interferers in the sample of received data and estimates parameters of each narrowband interferer, and

an excision filter that uses the estimated parameters of each narrowband interferer to reduce noise from the narrowband interferers.

12. An OFDM receiver as claimed in claim 11 wherein the excision filter is inserted into the OFDM receiver prior to a Fourier transform operator.

13. An OFDM receiver as claimed in claim 11 or claim 12 wherein the narrowband interference detector estimates the demodulated carrier frequency, magnitude and phase of the narrowband interferers.

14. An OFDM receiver as claimed in any one of claims 11 to 13 wherein the narrowband interference detector includes a Fourier transform operator arranged to perform a Fourier transform on the samples and perform a periodogram search on the output of the Fourier transform operator to identify peaks in the periodogram and at least one phase lock loop arranged to lock onto a peak identified by the periodogram search.

15. An OFDM receiver as claimed in claim 14 wherein the narrowband interference detector is further arranged to estimate the frequency of an interferer as the location of a peak on the corresponding periodogram, estimate the magnitude of the interferer as the amplitude of the corresponding periodogram peak, and estimate the phase of the interferer as the phase of the corresponding periodogram peak.

16. An OFDM receiver as claimed in any one of claims 11 to 15 wherein the narrowband interference detector includes a timer and a filter design module.

17. An OFDM receiver as claimed in any one of claims 11 to 16 wherein the OFDM receiver is further arranged to provide an estimate of the start of an OFDM data packet to the narrowband interference detector.

18. An OFDM receiver as claimed in claim 17 wherein the narrowband interference detector is arranged to innovate the phase lock loop(s) until either the timer times out or an OFDM packet is received.

19. An OFDM receiver as claimed in claim 18 wherein the phase locked loops are arranged to estimate the carrier frequency of the narrowband interferers.

20. An OFDM receiver as claimed in claim 19 wherein one phase locked loop is used for each interferer.

21. An OFDM receiver as claimed in any one of claims 18 to 20 wherein the current narrowband interferer carrier frequency estimates from the phase locked loops that have achieved "lock" are used by the filter estimator to initialise an excision filter when an OFDM packet is detected.

22. An OFDM receiver as claimed in any one of claims 11 to 21 wherein the excision filter has impulse response duration less than the OFDM guard interval.